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PATENT SPECIFICATION

765,034



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COMPLETE SPECIFICATION

Centrifugal Clarifying Apparatus and a Clarifying Process using said Apparatus

I, PAUL, JULES, CLÉMENT, EUGÈNE SIMON-ART, a subject of the King of the Belgians, of 73, Haachstraat, Veltem-Beisem, Belgium, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a centrifugal clarifying apparatus for eliminating from a liquid microscopic particles which are heavier than the liquid, more particularly for eliminating the greater part of the bacteria contained in milk or similar liquids.

Due to its qualitative and quantitative bacteria content, crude milk as such is inadequate for use as a foodstuff or for the preparation of by-products. It is usually essential, both from the economic standpoint and the hygienic one, to subject it to a treatment which destroys all or most of the bacteria it contains. The present treatment of the milk is based on the heating thereof and is effected either by sterilization or by pasteurization.

The treatment having for its basis heating of the milk has the drawback that the dead bacteria remain contained in the treated liquid. It is actually a destruction and not an elimination of the bacteria. Another drawback of the treatment by heating lies in the fact that milk with too great a number of bacteria must be treated under thermal conditions detrimental to the organoleptic qualities of the milk.

To obviate these drawbacks, the treatment by heating is combined with a treatment by centrifuging.

It has been proposed to subject milk and other liquids to a centrifugal force of 30,000 g. so as to eliminate substantially all the bacteria therein. Such treatment is impracticable firstly because the centrifugal force of 30,000 g. which is recommended is impracticable industrially, secondly because

said force causes an undue loss of dry material of the milk and, finally, because semi-industrial tests made by the applicant have revealed an unforeseen fact, namely, the fast reduction of the separating power during centrifuging. Indeed, while a large percentage of the bacteria in the milk is eliminated after a few minutes of rotation of a centrifugal apparatus with a speed corresponding to a centrifugal force of 20,000 or 14,000 g. this percentage is less when the apparatus has been running for 20 to 30 minutes. This notable decrease in the separating power which was unforeseen previously is illustrated by the following examples which concern pre-heated milk subjected to a centrifugal force of 14,308 g.

Pre-heating temp- erature	Number of bacteria in the pre- heated milk	Percentage of bacteria remaining in the cen- trifuged milk (after setting the centrifuging appa- ratus in motion)			
°C	(x)	2 min	10 min	30 min.	
66	3,600	6.6	23.0	53.8	70
66	1,550	8.3	33.6	96.7	
68	3,500	2.8	3.9	35.7	
69	640	2.8	14.0	29.5	
70	1,100	2.9	9.4	51.8	75
70	2,200	2.4	6.5	32.7	
71	630	2.0	8.0	55.5	
71	260	4.6	15.0	58.4	
71	220	2.5	26.3	44.5	
71	780	3.9	10.6	57.6	80
(x) in thousands per ml.					

(x) in thousands per ml.

This decrease in efficiency with time excludes any possibility of industrial application.

The inventor has noticed that the object aimed at, that is to maintain a high percentage of eliminated bacteria during centrifuging, is obtained by using a centrifugal clarifying apparatus the bowl of which is provided with a small opening or passage for changing the normal circuit of the liquid

[Price 2]

to be treated but which does not permit the passage therethrough of any appreciable quantity of liquid or centrifuged deposit.

5 The influence of said small opening or passage may be explained as being due to the stoppage thereby of unfavourable turbulence phenomena which occur in the bowl of a centrifugal clarifying apparatus, and which are prevented by a radial current caused by the suction created by the small opening. If at 10 the start of the centrifuging said unfavourable turbulence does not occur, it is probably because it is compensated by the electrostatic forces of the metal wall and of the bacteria adhering thereon. Once the metal wall is 15 covered by a layer of "centrifuged deposits", said forces do not intervene any more.

According to the invention there is provided a centrifugal clarifying apparatus from 20 which clarified liquid is continuously discharged whilst separated solids are deposited on the interior surface of the bowl of the apparatus, and which is characterised in that the normal circuit of liquid to be 25 treated is varied by the provision in the bowl of at least one passage which extends therethrough and is of small cross-section, that is a cross-section such as will be afforded by a passage the diameter of which is less than 1 mm., adapted at all times to permit 30 communication between the interior of the bowl and the atmosphere.

The diameter of the passage may be in the range from 0.1 to 0.4 mm.

35 Further according to the invention there is provided a process for eliminating from a liquid microscopic particles heavier than the liquid, more particularly for eliminating bacteria from milk or similar liquids, whereby 40 said liquid is centrifuged in a centrifugal clarifying apparatus from which clarified liquid is continuously discharged whilst separated solids are deposited on the interior surface of the bowl of the apparatus, and 45 which is characterised in that the normal circuit of liquid to be treated is varied by the provision in the bowl of at least one passage which extends therethrough and is of small cross-section, that is a cross-section such as 50 will be afforded by a passage the diameter of which is less than 1 mm., adapted at all times to permit communication between the interior of the bowl and the atmosphere.

The centrifuging may be effected with a 55 centrifugal force lower than 15,000 g.

The term "similar liquid" is deemed to include skim milk, partially skimmed milk, milk cream, milk enriched with fatty materials, 60 as well as any mixture of said products, homogenized or not, with one another or with the milk.

In order that the invention may be clearly understood one embodiment thereof will now 65 be described with reference to the accompanying drawing which is a view, in section, of the

bowl of a centrifugal clarifying apparatus according to the invention.

Milk to be treated is supplied to the bowl 1 through a channel 2 provided in a member 3 which is located in the bowl by a ring 4 which 70 co-operates with projections 5 provided inside a cover 7. The cover 7 is attached on the bowl 1 and a sealing joint 6 is provided. The liquid leaves the bowl along the path indicated by arrows 8 and it is discharged 75 through openings 9 provided in the upper part of the cover 7.

In order to maintain the separating power of the apparatus at a constant value, the bowl is provided in its vertical wall with a passage 80 10 extending therethrough and having a small cross-section, that is a cross-section such as will be afforded by a passage the diameter of which is less than 1 mm. and 85 which is preferably in the range from 0.1 to 0.4 mm. The passage permits communication between the interior of the bowl and the atmosphere at all times. The passage 10 is not provided for evacuating liquid or deposits 90 and differs, therefore, from similar openings such as have been provided in the bowl of a centrifugal creamer for the creaming of sour cream for the continuous manufacture of butter. The loss of an inappreciable quantity 95 of liquid through the opening 10 is unavoidable.

The examples shown on page 3 illustrate the constancy of the separating power obtained by using a centrifugal clarifying apparatus with an output of 180 litres per hour, the bowl 100 of which was provided with an opening of 0.35 mm. diameter. The centrifugal force applied was 12,242 g.

It is to be noticed that the centrifugal clarifying apparatus will actually be part of 105 an equipment effecting also the pasteurization or sterilization of the milk or similar liquid. If the milk is subjected to pasteurizing, it may be centrifuged at the pasteurizing temperature. If, however, the milk is 110 sterilized, the centrifuging precedes the sterilizing. The centrifuging may be effected in combination with the manufacturing of condensed milk, milk powder, cheese or other by-products. 115

While the centrifugal clarifying apparatus described above has a particular application in the treatment of milk and similar liquids, it is to be understood that other uses are not 120 excluded.

What I claim is:—

1. A centrifugal clarifying apparatus from which clarified liquid is continuously discharged whilst separated solids are deposited on the interior surface of the bowl of the 125 apparatus, characterised in that the normal circuit of liquid to be treated is varied by the provision in the bowl of at least one passage which extends therethrough and is of small cross-section, that is a cross-section such as 130

Pre-heating temperature	Number of bacteria in the pre-heated milk	Percentage of bacteria remaining in the centrifuged milk (after setting the centrifuging apparatus into motion)				
°C.	(x)	2 min.	10 min.	20 min.	30 min.	50 min.
75	17	2.9	2.6	3.5	4.1	3.2
75	22	2.4	2.4	2.8	3.9	5.5
75	550	2.1	2.8	2.6	3.6	3.9
70	42	2.3	1.9	4.3	7.1	5.4
70	100	1.2	0.7	1.0	2.2	3.2
70	160	2.3	2.9	3.9	2.8	4.2
70	165	5.5	4.1	4.6	5.9	5.4
70	12	6.3	6.8	4.7	8.1	7.5

(x) in thousands per ml.

will be afforded by a passage the diameter of which is less than 1 mm, adapted at all times to permit communication between the interior of the bowl and the atmosphere.

5 2. An apparatus according to Claim 1, wherein the diameter of the passage is in the range of from 0.1 to 0.4 mm.

3. A process for eliminating from a liquid microscopic particles heavier than the liquid, more particularly for eliminating bacteria from milk or similar liquids, whereby said liquid is centrifuged in a centrifugal clarifying apparatus from which clarified liquid is continuously discharged whilst separated solids are deposited on the interior surface of the bowl of the apparatus, and which is characterised in that the normal circuit of liquid to be treated is varied by the provision in the bowl of at least one passage which extends therethrough and is of small cross-

section, that is a cross-section such as will be afforded by a passage the diameter of which is less than 1 mm, adapted at all times to permit communication between the interior of the bowl and the atmosphere.

4. A process according to Claim 3, whereby said centrifuging is effected with a centrifugal force lower than 15,000 g.

5. A centrifugal clarifying apparatus constructed and arranged to operate substantially as herein described with reference to the accompanying drawing.

6. A process for eliminating microscopic particles substantially as herein described with reference to the accompanying drawing.

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765,034 COMPLETE SPECIFICATION

1 SHEET

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